National Institute of Environmental Health Sciences

Impacts of 21st century climate change on global air pollution-related premature mortality

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Abstract:

Climate change modulates surface concentrations of fine particulate matter (PM2.5) and ozone (O-3), indirectly affecting premature mortality attributed to air pollution. We estimate the change in global premature mortality and years of life lost (YLL) associated with changes in surface O-3 and PM2.5 over the 21st century as a result of climate change. We use a global coupled chemistry-climate model to simulate current and future climate and the effect of changing climate on air quality. Epidemiological concentration-response relationships are applied to estimate resulting changes in premature mortality and YLL. The effect of climate change on air quality is isolated by holding emissions of air pollutants constant while allowing climate to evolve over the 21st century according to a moderate projection of greenhouse gas emissions (A1B scenario). Resulting changes in 21st century climate alone lead to an increase in simulated PM2.5 concentrations globally, and to higher (lower) O-3 concentrations over populated (remote) regions. Global annual premature mortality associated with chronic exposure to PM2.5 increases by approximately 100 thousand deaths (95 % confidence interval, CI, of 66-130 thousand) with corresponding YLL increasing by nearly 900 thousand (95 % CI, 576-1,128 thousand) years. The annual premature mortality due to respiratory disease associated with chronic O-3 exposure increases by +6,300 deaths (95 % CI, 1,600-10,400). This climate penalty indicates that stronger emission controls will be needed in the future to meet current air quality standards and to avoid higher health risks associated with climate change induced worsening of air quality over populated regions.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: SRES A1B

Early Warning System:

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

A focus of content

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Temperature

Air Pollution: Ozone, Particulate Matter

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Morbidity/Mortality, Respiratory Effect

Respiratory Effect: Other Respiratory Effect

Respiratory Condition (other) : respiratory disease morbidity

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Outcome Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Long-Term (>50 years)

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content